

United States
Department of
Agriculture

Forest
Service

Southwestern
Region



Forest Pest Management Report

R-3 88-1

BIOLOGICAL EVALUATION
Western Spruce Budworm

Carson National Forest
New Mexico
December 1987



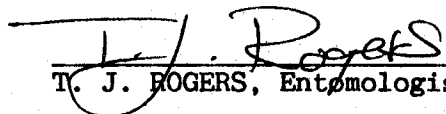
BIOLOGICAL EVALUATION
Western Spruce Budworm

Carson National Forest
New Mexico

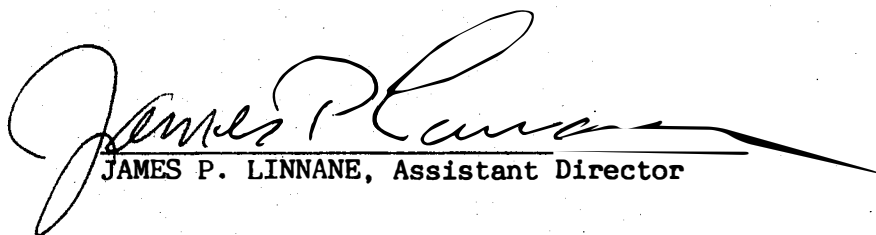
December 1987

USDA Forest Service, Southwestern Region
State and Private Forestry
Forest Pest Management
517 Gold Avenue, SW
Albuquerque, New Mexico 87102

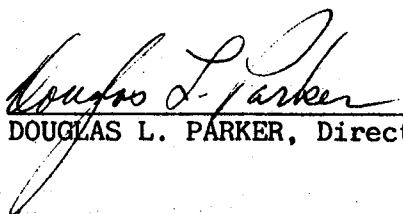
PREPARED BY:


T. J. ROGERS, Entomologist

RECOMMENDED BY:


JAMES P. LINNANE, Assistant Director

APPROVED BY:


DOUGLAS L. PARKER, Director

INTRODUCTION

During July and August, 1987, a western spruce budworm (WSB), Choristoneura occidentalis Free., biological evaluation was conducted on selected areas of the Carson National Forest (CNF). This biological evaluation consisted of: (1) An insect and disease aerial detection survey (refer to 3410 letter dated August 18, 1984), and (2) a WSB egg mass survey conducted from August 17-28, 1987. The purpose of this evaluation is to provide CNF resource managers information on:

1. The extent and severity of the current WSB outbreak on the CNF and adjoining interspersed lands of other Federal and private ownership.
2. WSB defoliation trends expected to occur in 1988.
3. General alternative management approaches to the current WSB situation.

SUMMARY OF THE CURRENT OUTBREAK

WSB-caused defoliation in northern New Mexico was first visibly detected¹ on the Taos Pueblo Indian Reservation in 1975 and the Questa and Camino Real Ranger Districts (RD) (formerly Taos and Penasco RDs) in 1976. New infestations were next detected on the Canjilon, El Rito, and Tres Piedras RDs in 1982. In 1985, WSB defoliation was detected for the first time in recent history on the southern half of the Camino Real RD.

TECHNICAL INFORMATION

Insect. Western spruce budworm, Choristoneura occidentalis Free.

Hosts. Douglas-fir, Pseudotsuga menziesii (Mirb.) Franco.
White fir, Abies concolor (Gord. & Glend.) Lindl.
Subalpine fir, Abies lasiocarpa (Hook.) Nutt.
Blue spruce, Picea pungens Engelm.
Engelmann spruce, Picea engelmannii Parry.

Life History. The WSB completes one generation each year (Furniss and Carolin 1977)

<u>Stage</u>	<u>Time</u>	<u>Location on host</u>
Egg	August	On needles
Small larvae	Overwinter	In hibernaculum (silken cocoons) on branches and trunk.
Larger larvae	June	On buds, strobile, and foliage.
Pupae	July	On foliage.
Adults	August	In flight.

¹Visible defoliation is based on aerial insect and disease detection surveys.

Evidence of Infestation.

1. Presence of partially eaten foliage.
2. Immature and/or mature larvae feeding on current year's needles.
3. Current year's shoots webbed together.
4. Trees dying from the top downward after several years of heavy defoliation.

EXTENT OF CURRENT OUTBREAK

The results of our most recent insect and disease detection surveys show that WSB-caused defoliation on the CNF and interspersed lands of other Federal and private ownership decreased from 203,036 acres in 1986 to 168,760 acres in 1987. Most of the defoliation detected in 1987 occurred on the west half of the Forest on the Canjilon, El Rito, and Tres Piedras RDs. Intensity of defoliation was categorized as: Light - 31,280 acres, moderate - 126,200 acres, and heavy - 11,280 acres. These data are summarized by ownership and intensity of defoliation below and in Table 1.

Defoliation

	<u>Light</u>	<u>Moderate</u>	<u>Heavy</u>	<u>Total</u>
Carson NF				
Camino Real RD	7,240	1,240	-	8,480
Canjilon RD	520	6,600	-	7,120
El Rito RD	10,240	55,080	1,960	67,280
Valle Vidal Unit ¹	3,280	3,240	200	6,720
Tres Piedras RD	10,000	58,160	9,120	77,280
Jicarilla Apache IR	-	1,880	-	1,880
Taos Pueblo IR	-	-	-	-
Total	31,280	126,200	11,280	168,760

¹ Administered by Questa RD

METHODS AND MATERIALS

WSB egg mass surveys were conducted in August 1987 to obtain information on insect larval densities and respective defoliation trends expected to occur on the Forest and adjacent interspersed lands of mixed ownership in 1988. Egg mass surveys were conducted on the Camino Real (60 plots), Canjilon (5 plots), El Rito (10 plots), Questa (17 plots), and Tres Piedras (20 plots) RDs. Each plot consisted of a three tree cluster of one of the following host species: Douglas-fir, white fir, or spruce in descending order of preference. Sample trees were: (1) open grown, (2) dominant or co-dominant, (3) 30 to 60 feet in height with full crowns, and (4) located within a 1-acre area.

Sampling consisted of pole pruning two branches (45 cm in length) from the opposite sides of the midcrown. Foliage samples were placed in a large plastic

garbage bag, two branches per bag, one bag per tree, along with a plot identification card indicating plot number and unit sampled. To facilitate handling and to prevent separation or loss of the foliage samples, the first two bags of each plot were placed into the third bag. All foliage samples were then transported to the laboratory and stored in a walk-in cooler preset to 40 degrees C.

In the laboratory, the foliage samples were examined under ultraviolet light for WSB egg masses. Needles bearing egg masses were classed as being from current year's foliage or the previous year's foliage. All egg masses on the current year's foliage were classed as new, and their characteristics formed the basis for aging egg masses found on previous year's foliage. Means were determined for both the plots and area sampled. Defoliation trends expected to occur in 1988 were determined according to McKnight et. al. as summarized below.

<u>Egg Mass Density^a</u>	<u>Predicted Defoliation Class^b</u>
<1.55	Undetectable for all infestations
1.71 to 6.20	Undetectable for "static" infestations
	Light for "increasing" infestations
9.30 to 31	Light for "static" infestations
	Moderate for "increasing" infestations
>34.10	Moderate for "static" infestations
	Heavy for "increasing" infestations

^a Number of egg masses per square meter of foliage.

^b Defoliation class limits (percent of new growth).

Undetectable <5 percent

Light >5 to 35 percent

Moderate >35 to 65 percent

Heavy >65 percent

RESULTS AND PREDICTION OF TREND

The results of this biological evaluation and prediction of defoliation trends expected to occur in 1988 are summarized below by individual administrative units.

East half of the Forest.

Camino Real RD. Areas of defoliation on the Camino Real RD (formerly the Taos and Penasco RDs) decreased substantially from 52,240 acres in 1986 to 8,480 acres in 1987, a 6-fold decrease from 1986 defoliation levels (Figure 1). Defoliation occurring in 1987 was limited to the southern boundary of the Rancho Del Rio Grande Grant, just south of Pot Creek along State Highway 3 and west of the Pecos wilderness, within the Las Trampas and Francisco Montes Vigil Grant Areas (Figure 1). Intensity of defoliation within these defoliated areas ranged from light (7,240 acres) to moderate (1,240 acres). Budworm-related defoliation was not aerially detected in the Rio Fernando de Taos, Rio Chiquito, or Rito de la Olla drainages in 1987.

WSB egg mass surveys conducted on this District in 1987 indicate that WSB insect population densities are currently at low levels within the Fernando de Taos and most of the Rio Pueblo drainages. Egg mass densities per square meter

of foliage within these drainages ranged from 0.3 to 5.9 and 1.0 to 7.6 respectively. Based on these data, defoliation damages in these drainages will be largely undetectable again in 1988. However, a few areas of light and moderate defoliation may occur in Comales Canyon and La Cueva Canyon and northwest of Angostura Ridge (Rio Pueblo drainages). These areas were not aerially sprayed during the WSB suppression projected conducted on the Forest in 1987.

Egg mass surveys conducted along the Rio Grande del Rancho drainage from Pot Creek south to U.S. Hill and Canon Hondo indicate WSB infestations will cause moderate to heavy defoliation within these areas in 1988. Defoliation will be heaviest near Maestas Park, where egg mass densities averaged 40.9 egg masses per square meter of foliage. These data are summarized below by drainage and area sampled.

Areas Sampled	N	Egg Mass Densities/ Sq. Meter of Foliage	1988 Defoliation
Fernando de Taos Drainage			
Capulin Canyon	5	4.2 ± 2.3	Undetectable
FS-437 (Garcia Park Road)	5	3.2 ± 1.1	Undetectable
Apache Sale Area	5	5.9 ± 2.8	Undetectable
Palo Flechado Pass	5	0.3 ± 0.3	Undetectable
Rio Grande del Rancho Drainage			
Maestas Park	5	40.9 ± 12.6	Heavy
U.S. Hill	5	12.7 ± 8.9	Light to Moderate
Rio Pueblo Drainage			
La Cueva Canyon	5	7.6 ± 4.5	Light
Sipapu Ski Area ¹	5	1.0 ± 1.0	Undetectable
La Junta Canyon ¹	10	3.0 ± 1.0	Undetectable
Polycarpio Canyon ¹	5	1.9 ± 0.9	Undetectable
Picachio Canyon ¹	5	1.3 ± 0.5	Undetectable

¹ Areas treated with B.t. at 16 BIUs during the 1987 WSB Suppression Project, CNF.

Questa RD. WSB insect population densities on this District are currently at low levels; no defoliation damages were detected on this unit in 1987. Egg mass density surveys on this District in 1987 indicate WSB insect population densities and subsequent defoliation damages will be undetectable again in 1988. The results of the egg mass surveys conducted on this District and 1988 defoliation prediction trends are summarized below.

Areas Sampled	N	Egg Mass Densities/ Sq. meter of foliage	1988 Defoliation
Cabresto Canyon	4	4.3 $\pm$ 3.0	Undetectable
Hondo Canyon	4	1.7 $\pm$ 1.7	Undetectable
Lower Red River Canyon ¹	5	0.0	Undetectable
Upper Red River Canyon ²	4	0.6 $\pm$ 0.5	Undetectable

¹ Columbine Campground east to Red River Ski Area.

² Red River Ski Area South to East Fork of the Red River.

Valle Vidal Unit. WSB defoliation on this unit decreased from 18,480 acres in 1986 to 6,720 acres in 1987, a decrease of 64 percent from 1986 levels. These data suggest that the current outbreak on this unit may be declining. Intensity of defoliation detected in 1987 was largely light to moderate (Figure 2).

West half of the Forest

Canjilon RD. Defoliation on the Canjilon RD increased from 4,960 acres in 1986 to 7,120 acres in 1987. The largest area of contiguous defoliation (6,600 acres) was detected west of Canjilon Mountain. Smaller areas of defoliation also occurred near Canjilon Lakes (Figure 3). Egg mass densities sample at the Trout Lakes recreation area ranged from 0.0 to 26.2 and averaged 15.3. Based on these data, defoliation on this District will be light to moderate again in 1988.

El Rito RD. Acres defoliated by the WSB increased substantially, from 41,000 acres in 1986 to 67,280 acres in 1987 (Figure 4). Although a few areas of heavy (1,960 acres) defoliation occurred on this District, most of the defoliation observed ranged from light (10,240 acres) to moderate (55,080 acres).

Egg mass surveys conducted along FS-106 indicate WSB egg mass densities range from 2.1 to 31.8 and average 14.7 egg mass densities per meter square of foliage. On the basis of these data, WSB insect population and defoliation levels in 1988 will remain relatively unchanged from 1987 levels.

Tres Piedras RD. Although WSB infestations on this District have been suppressed on three separate occasions (1982, 1983, 1984), the effectiveness of these suppression efforts was of relatively short duration. WSB insect populations are again at outbreak levels throughout most of the mixed conifer type on this administrative unit (Figure 5). Defoliation in 1987 remained relatively unchanged from the previous year, increasing only slightly from 73,796 acres to 77,280 acres. Although some areas of heavy defoliation were detected along the northern portions of this District, defoliation was largely categorized as light to moderate. Observations made in areas defoliated for one, two, and three consecutive years indicated that permanent tree damages (topkill) are still relatively minor and insignificant at the present time.

Egg mass densities on this District, which ranged from 2.4 to 84.4, and averaged 44.8 egg masses per square meter of foliage, indicate defoliation damages in 1988 will be heavy. These data and 1988 defoliation prediction trends on this District are summarized below.

Areas Sampled	N	Egg Mass Densities/ Sq. Meter of Foliage	1988 Defoliation
Cunningham Gulch (State Highway 64)	3	44.1 $\pm$ 1.8	Heavy
Hopewell Lake (State Highway 64)	7	50.5 $\pm$ 8.1	Heavy
Oso Springs (FS-87)	7	45.7 $\pm$ 9.5	Heavy
Los Pinos (FS-87A)	5	35.9 $\pm$ 9.7	Moderate/ Heavy

MANAGEMENT ALTERNATIVES

Two general alternatives should be considered for short-term WSB management. These are: (1) No action and (2) direct suppression with insecticides. Silvicultural management of infested stands is not considered an effective suppression strategy in the short-term. However, silvicultural management to reduce WSB stand susceptibility/vulnerability in the long-term should be a principal consideration in all vegetation management activities on the Forest.

No action. This alternative allows the outbreak to progress subject to a variety of natural controls. It implies resource impacts generated by the outbreak do not conflict with management goals and objectives for the infested area. Generally, a brief analysis may be required to make this determination.

Direct suppression. Suppression tactics using insecticides can be considered for the current outbreak to reduce tree damages in the short-term, thus protecting resource values. Alternative approaches are as follows:

1. **Developed recreation sites.** Individual trees in campgrounds, picnic areas, and other high-use sites can be sprayed with ground-based equipment or treated with systemic insecticides to prevent defoliation and protect visual quality and "recreation experience" objectives. These treatments are generally successful in preventing significant amounts of defoliation during the year of treatment; however, moth and larval dispersal from nearby untreated trees may reinfest treated trees, necessitating annual retreatment in subsequent year.

2. **High valued Forest areas.** Aerial insecticide applications can be used to prevent unacceptable damages to high valued areas. To maximize effectiveness, treatments should be considered early in the outbreak cycle and before budworm populations reach high densities (>15 larvae per 100 buds). This treatment strategy has short-term effectiveness and may require several

treatments during the outbreak cycle. Alternative development using this strategy must consider current and predicted budworm population trends, projected stand damages, and a benefit/cost or comparable economic analysis.

The probability of success (meeting management objectives) for a suppression strategy is a principal factor to consider in developing alternatives or deciding on a course of action. Some factors affecting this probability, which should be considered, are choice of insecticide, application rate, method of delivery, terrain to be treated, condition of targeted trees, and budworm resurgence or reinvasion.

RECOMMENDATIONS

Camino Real and Questa RDs. The 1987 biological evaluation, which includes the Rio Pueblo and Red River drainages, indicates WSB population densities are at very low levels. Defoliation during 1988 is expected to be minor and generally undetectable. We recommend no action during 1988.

Canjilon and Tres Piedras RDs. Although WSB population densities have increased to outbreak levels throughout most of the host type, permanent tree damages (topkill and mortality) are still minor. However, substantial increases in permanent tree damages are likely during the next few years. These damages include topkill, radial growth loss, and mortality in seedling, sapling, and pole size class host trees. Nevertheless, it is unlikely future stand damage will approach that which occurred in Red River. Should these tree damages conflict with planned management goals and objectives, we recommend a direct suppression strategy be considered during 1988. Postponing the decision to a later year will likely reduce the effectiveness of any suppression strategy, while allowing an increase in resource damage.

El Rito RD. We recommend no action against WSB infestations on this District. Direct suppression is no longer practical or economical since extensive permanent tree damages have already occurred throughout most of the mixed conifer type.

Long-term management Forest-wide. The WSB is a long-term forest management problem and should be addressed through long-range planning incorporating Integrated Resource Management/Integrated Forest Protection. The objective is to reduce stand susceptibility/vulnerability. We concur and support the management direction outlined in the Forest Plan.

LITERATURE CITED

- Bennett, Dayle D. and James P. Linnane. 1985. Western spruce budworm suppression project 1984. Lincoln National Forest, Mescalero Apache Indian Reservation, and adjacent private lands, New Mexico. USDA Forest Service, R-3 85-11. 41 pp.
- Furniss, R. L., and V. M. Carolin. 1977. Western Forest Insects. USDA Forest Service, Misc. Publ. No. 1339. 654 pp.

McKnight, M. E., J. F. Chansler, D. B. Cahill, and H. W. Flake, Jr. 1970. Sequential plan for western spruce budworm egg mass surveys in the central and southern Rocky Mountains. USDA Forest Service, Res Not RM-174. 5 pp.

Telfer, William G., Iral R. Ragenovich, and T. J. Rogers. 1982. Western spruce budworm suppression and evaluation project using carbaryl--1977. Santa Fe National Forest and Jemez Indian Reservation, New Mexico. Progress Report No. 5, R-3 82-7. 18 pp.

TABLE 1. Summary of the egg mass and aerial detection surveys conducted on the Camino Real, Questa, El Rito, and Tres Piedras Ranger Districts, Carson National Forest.

Ranger District		1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
CAMINO REAL													
New egg masses/ sq. meter foliage		38.3	22.3	36.3	42.8	50.6	14.1	17.2	26.3	25.0	11.7	5.9	6.4
Egg mass density ratio ^a		1.7:1	0.6:1	1.6:1	1.2:1	1.2:1	0.3:1	1.2:1	1.5:1	0.9:1	0.5:1	0.3:1	1.1:1
Actual defoliation (acres) ^b	L	9,400	15,040	2,725	6,477	31,200	6,375	7,125	18,500	15,625	52,452	20,440	7,240
	M	6,600	10,800	2,790	9,191	26,750	41,125	18,550	6,825	26,550	30,346	---	1,240
	H	560	---	4,250	282	6,975	15,775	3,375	50	31,750	7,086	---	---
	TOTAL	16,560	25,840	9,765	15,950	64,925	63,275	29,050	25,375	73,925	89,884	20,440	8,480
QUESTA													
New egg masses/ sq. meter foliage		--- ^c	9.9	17.9	43.1	47.6	31.3	26.3	16.7	38.5	6.9	0.5	1.7
Egg mass density ratio		---	---	1.7:1	2.4:1	1.1:1	0.7:1	0.8:1	0.6:1	2.3:1	0.2:1	0.1:1	3.4:1
Actual defoliation (acres)	L	1,900	13,080	2,560	3,174	22,850	4,800	2,025	7,625	625	5,613	14,040	3,280
	M	300	960	2,330	5,197	15,550	39,700	8,550	1,975	17,750	23,733	1,640	3,240
	H	---	320	384	6,221	3,275	18,550	36,400	175	34,325	28,134	2,160	200
	TOTAL	2,200	14,360	5,274	14,592	41,675	63,050	46,975	9,775	52,700	57,480	17,840	6,720

TABLE 1. Summary of the egg mass and aerial detection surveys conducted on the Camino Real, Questa, El Rito, and Tres Piedras Ranger Districts, Carson National Forest. (Continued)

Ranger District		1980	1981	1982	1983	1984	1985	1986	1987
EL RITO									
New egg masses/ sq. meter foliage		29.7	33.5	18.6	42.6	20.8	---	---	14.7
Egg mass density ratio		---	1.1:1	0.5:1	2.3:1	0.5:1	---	---	---
Actual defoliation	L	325	1,700	20,275	7,225	3,925	15,012	24,600	10,240
(acres)	M	900	1,100	13,075	35,350	26,400	2,775	16,120	55,080
	H	75	200	600	1,275	23,750	503	280	1,960
	TOTAL	1,300	3,000	33,950	43,850	54,075	18,290	41,000	67,280
TRES PEIDRAS									
New egg masses/ sq. meter foliage		1.8	35.0	6.8	22.3	14.7	13.2	---	44.8
Egg mass density ratio		---	19.4:1	0.2:1	3.3:1	0.6:1	0.9:1	---	---
Actual defoliation	L	550	5,650	2,625	8,800	14,525	25,797	22,000	10,000
(acres)	M	---	50	1,725	9,650	25,725	18,903	49,720	58,160
	H	---	---	---	50	525	152	1,756	9,120
	TOTAL	550	5,700	4,350	18,500	40,775	44,852	73,476	77,280

^a Egg mass density ratio is the ration of new egg masses in the survey year to new egg massess in the previous year.

^b Actual defoliation as determined from aerial surveys: L = light, M = moderate, H = heavy.

^c Egg mass surveys were not conducted on these Districts in these years.

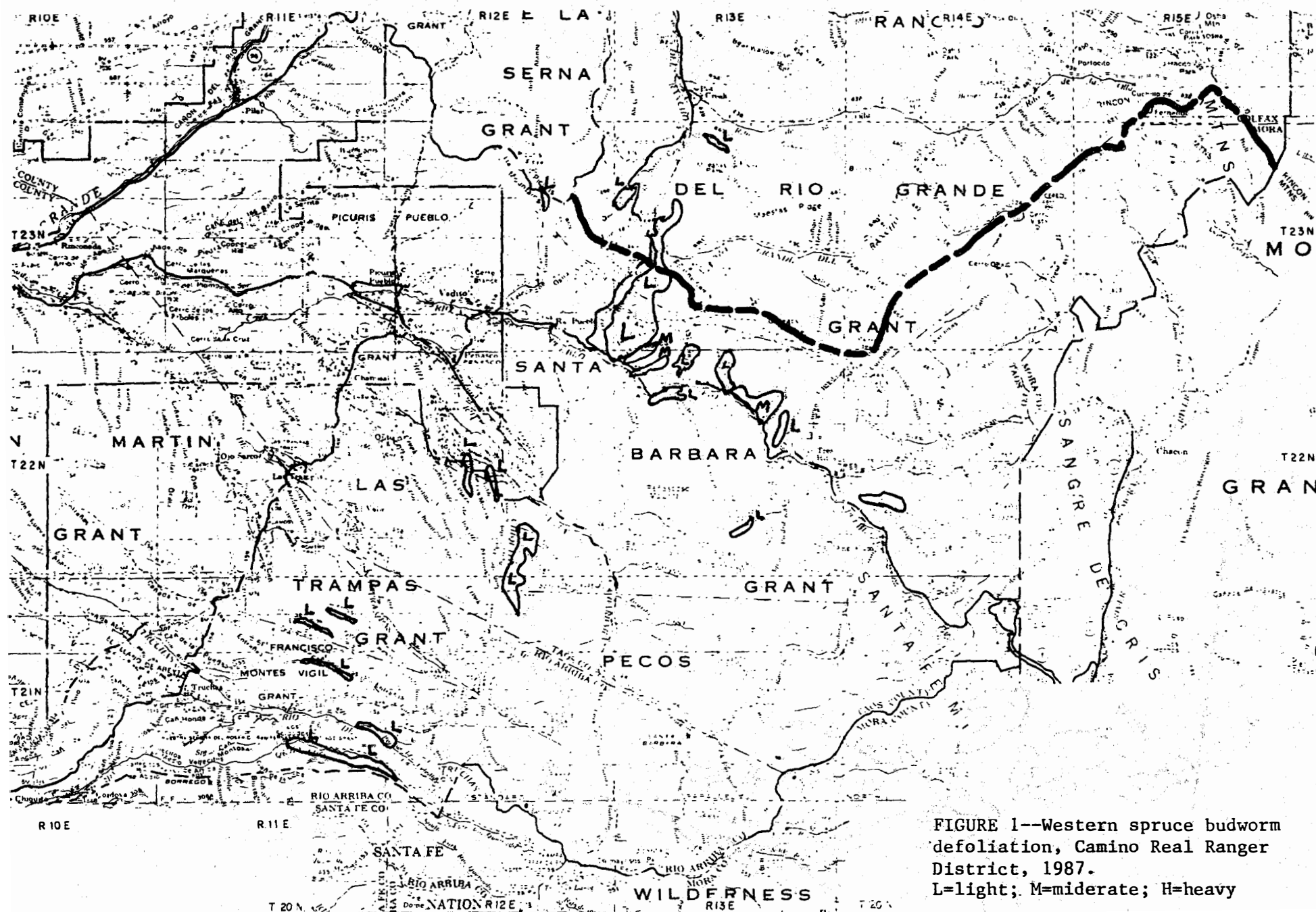
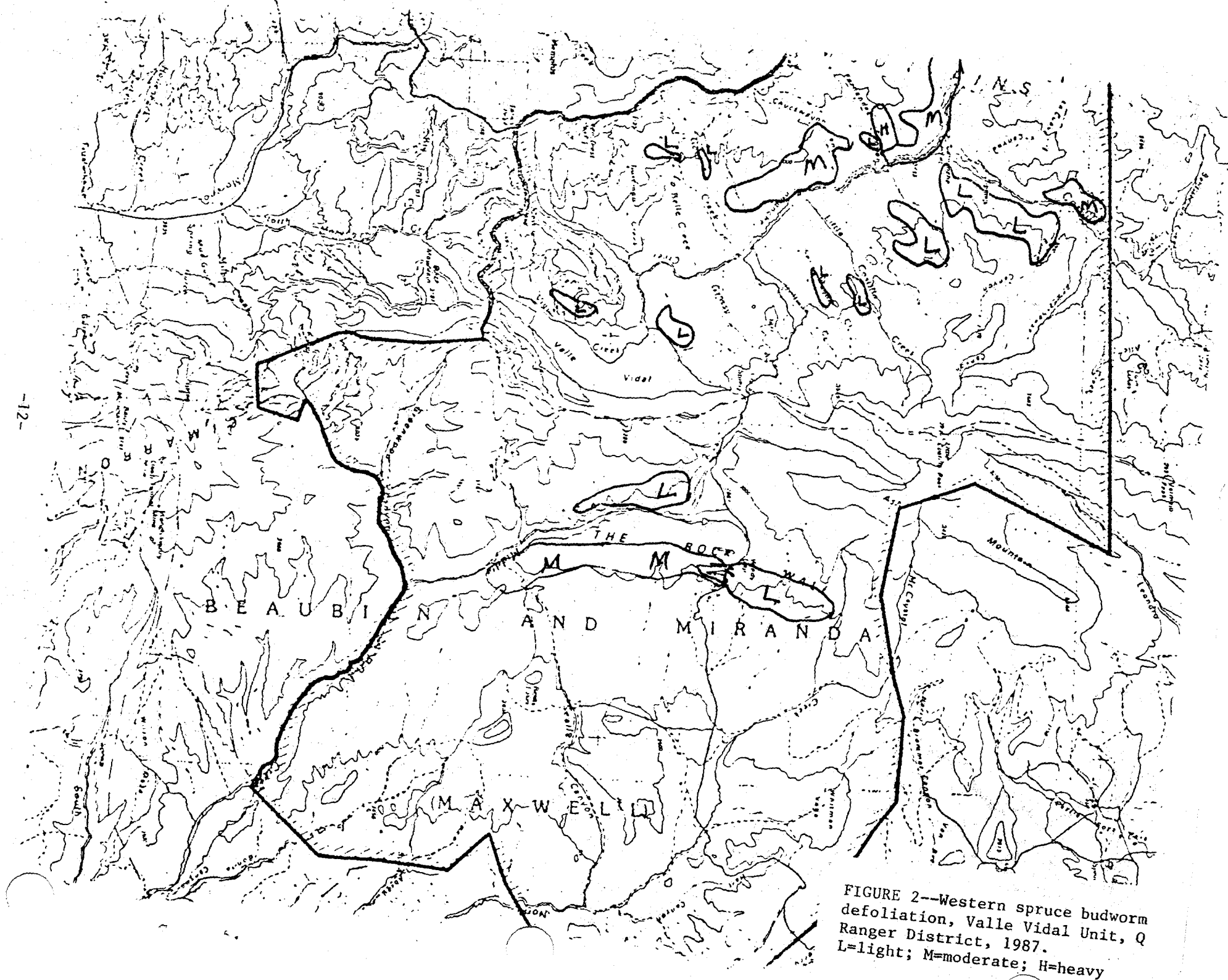
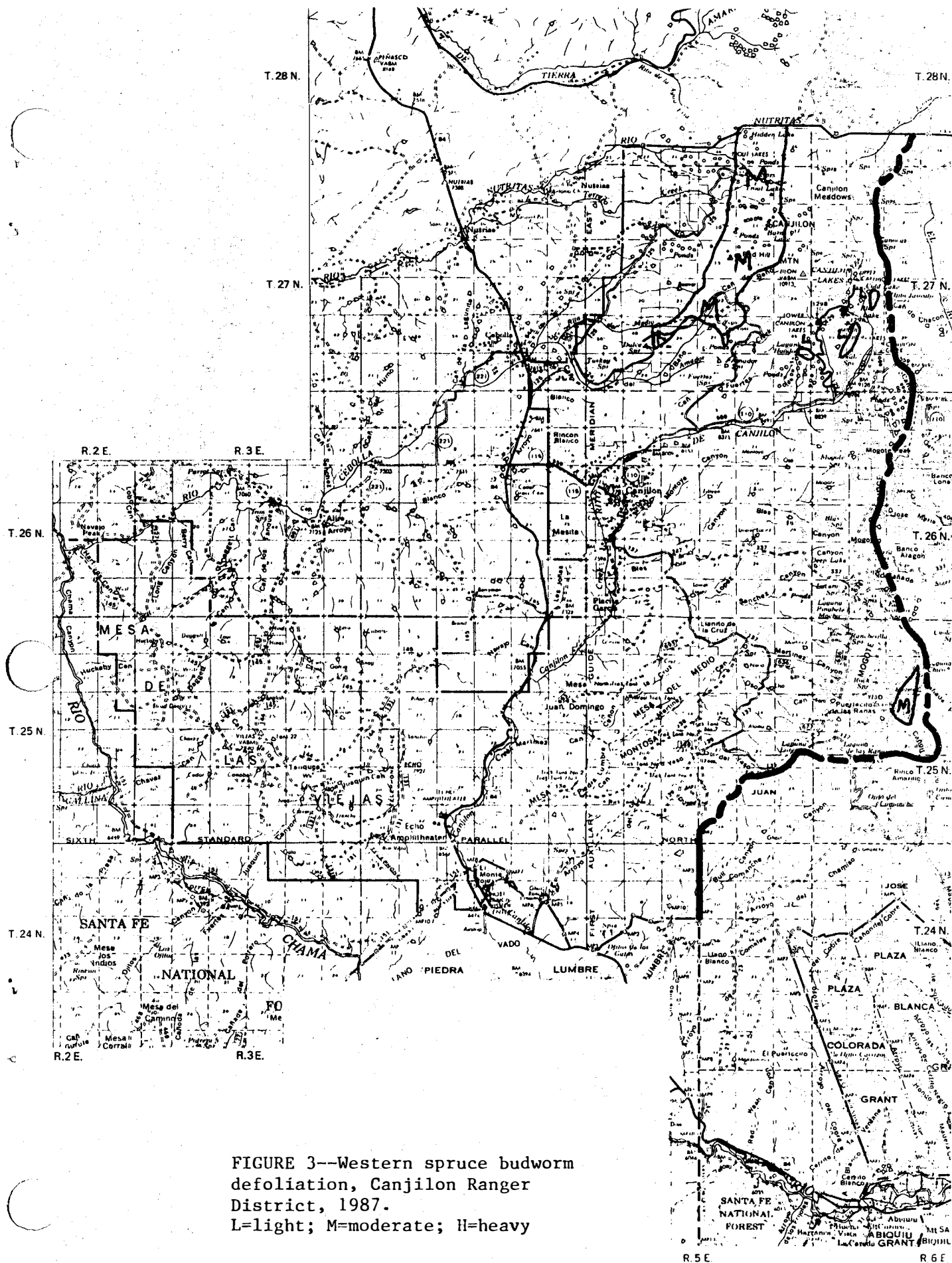


FIGURE 1--Western spruce budworm defoliation, Camino Real Ranger District, 1987.
L=light; M=moderate; H=heavy





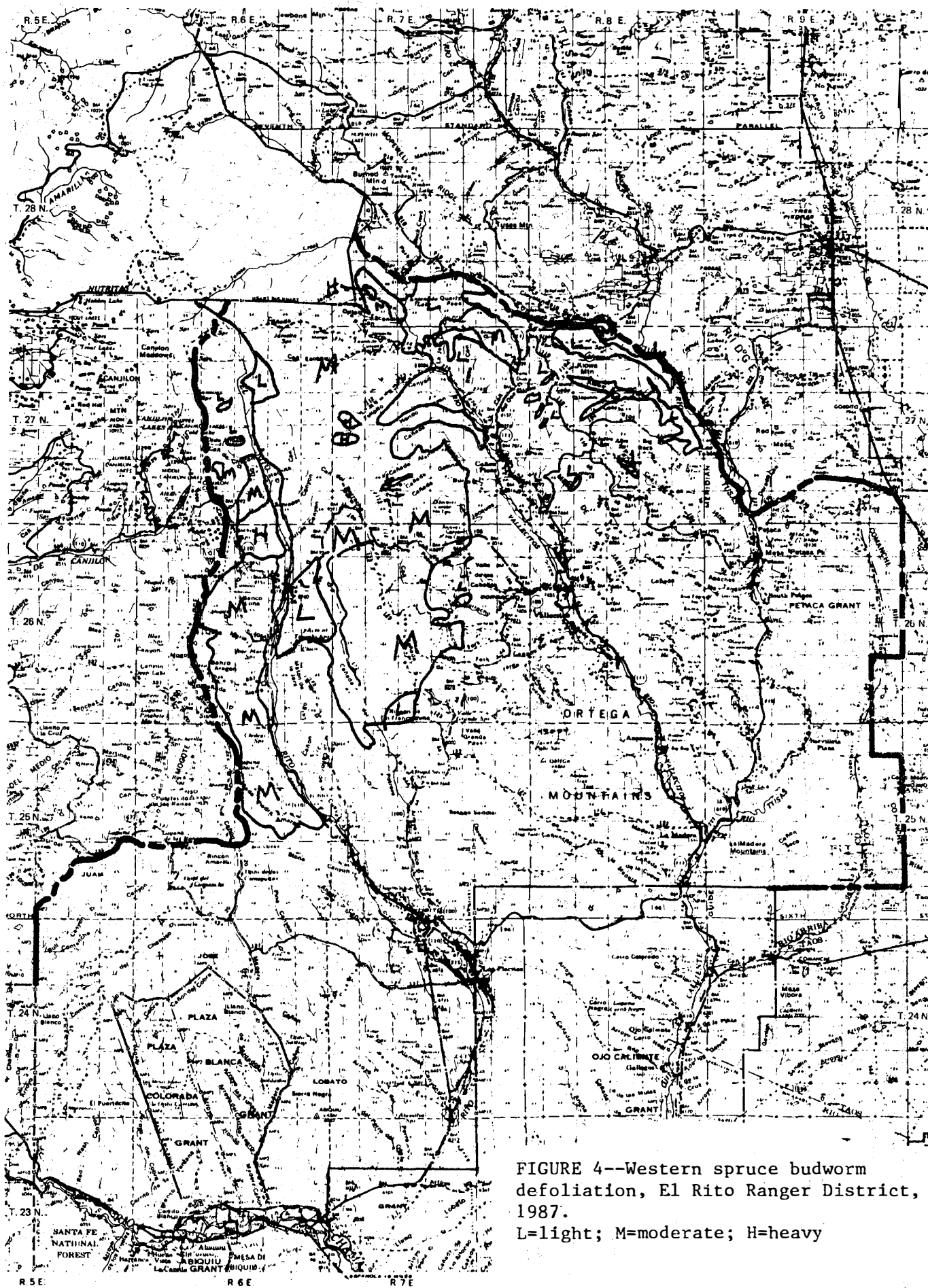


FIGURE 4--Western spruce budworm defoliation, El Rito Ranger District, 1987.

L=light; M=moderate; H=heavy

